# UNITED STATES PATENT AND TRADEMARK OFFICE

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 09/892,332 | 06/26/2001 | Ching-Wei Chang | TAL/7146.119 | 1906 |

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|---|---|
| 7590      10/02/2006 | EXAMINER |
| Timothy A. Long | THOMPSON, JAMES A |
| Chernoff, Vilhauer, McClung & Stenzel, LLP | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2625 | |

Timothy A. Long
Chernoff, Vilhauer, McClung & Stenzel, LLP
1600 ODS Tower
601 S.W. Second Avenue
Portland, OR 97204-3157

DATE MAILED: 10/02/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

| | Application No. | Applicant(s) |
|---|---|---|
| **Office Action Summary** | 09/892,332 | CHANG, CHING-WEI |
| | Examiner | Art Unit | |
| | James A. Thompson | 2625 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
  Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

1)☒ Responsive to communication(s) filed on *17 July 2006*.

2a)☒ This action is **FINAL**.     2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

4)☐ Claim(s) _____ is/are pending in the application.

    4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-22* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

## Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *26 June 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a)☐ All   b)☐ Some * c)☐ None of:

      1.☐ Certified copies of the priority documents have been received.

      2.☐ Certified copies of the priority documents have been received in Application No. _____.

      3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
    Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413)
    Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

## DETAILED ACTION

### *Response to Arguments*

1.    Applicant's arguments filed 17 July 2006 have been fully
considered but they are not persuasive.

In recited claims 1, 5 and 12, the intensity thresholds are
based on error thresholds, not the intensities themselves.  Kak-
utani (US Patent 5,553,166) clearly uses an intensity threshold
to perform thresholding on input image data, thus producing
quantized output image data (halftone data) (see, e.g., column
7, lines 12-33 of Kakutani).  Also, the intensity thresholds are
based on the error values (figure 6 and column 10, lines 40-51
of Kakutani).  For example, if the accumulated error of at least
one current pixel and a neighboring pixel (column 9, equation 4
of Kakutani) exceeds a first error threshold (column 11, lines
12-23 of Kakutani), then a first intensity threshold is selected
(column 10, lines 40-51 of Kakutani).

While Kakutani does not teach that said accumulated error
is the accumulated error of a *selected* one of a current pixel
and a neighborhood pixel, this limitation is a feature of the
present amendments to the claims.  In fact, this limitation
greatly alters the scope of the claims, since the criteria for
selecting the first intensity threshold is significantly altered
compare with the prior recitation of claims 1, 5 and 12.  Thus,
new grounds of rejection are necessitated to demonstrate that
the claims are taught by the prior art.  The new grounds of
rejection are set forth in detail below.

## *Claim Rejections - 35 USC § 102*

2.    The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3.    **Claims 20 and 22 are rejected under 35 U.S.C. 102(b) as being anticipated by Kakutani (US Patent 5,553,166).**

**Regarding claim 20:**  Kakutani discloses a halftoning encoder (figure 2 of Kakutani) comprising:

- (a) a selected thresholding unit (figure 2(36) of Kakutani) comparing an input density of a current pixel to a selected threshold intensity (column 8, equation 1 and lines 40-43 of Kakutani).

- (b) a threshold selection unit (figure 2(32) of Kakutani) selecting one of a plurality of threshold intensities for said selected threshold unit (column 8, lines 27-34 of Kakutani) in response to an accumulated error for at least one of said current pixel and a pixel neighboring said current pixel (column 9, equations 4-5 and lines 32-36 of Kakutani).

**Regarding claim 22:**  Kakutani discloses:

- (a) an error filter (figure 2(40) of Kakutani) distributing an error produced by printing said current pixel to a plurality of pixels neighboring said current pixel (column 8, lines 55-60 and column 9, equation 4 of Kakutani).

- (b) an error buffer (figure 2(42) of Kakutani) accumulating
  said distributed error for a pixel (column 9, lines 32-35
  of Kakutani).

## Claim Rejections - 35 USC § 103

4.    The following is a quotation of 35 U.S.C. 103(a) which
forms the basis for all obviousness rejections set forth in this
Office action:

> (a) A patent may not be obtained though the invention is not identically
> disclosed or described as set forth in section 102 of this title, if the
> differences between the subject matter sought to be patented and the prior
> art are such that the subject matter as a whole would have been obvious at
> the time the invention was made to a person having ordinary skill in the
> art to which said subject matter pertains.  Patentability shall not be
> negatived by the manner in which the invention was made.

5.    **Claims 1-4 and 12-18 are rejected under 35 U.S.C. 103(a) as
being unpatentable over Kakutani (US Patent 5,553,166) in view
of Satou (US Patent 5,159,471) and Ostromoukhov (US Patent
6,356,362 B1).**

**Regarding claim 1:**  <u>Kakutani discloses</u> a method of select-
ing an intensity threshold for an image halftoning system having
an accumulated error assigned to at least one pixel of an image
(column 10, lines 53-64 of Kakutani), said method comprising the
steps of:

- (a) selecting a first intensity threshold (for high density
  pixels) (column 8, lines 23-34 of Kakutani) if a said
  accumulated error of a current pixel and a neighboring
  pixel (column 9, equation 4 of Kakutani) exceeds a first
  error threshold (column 10, lines 40-51 and column 11,
  lines 12-23 of Kakutani).
- (b) selecting a second intensity threshold (for medium
  density pixels) (column 11, line 61 to column 12, line 2 of

Kakutani) if a said accumulated error exceeds a second
error threshold (column 10, lines 40-51 and column 11,
lines 12-17 of Kakutani) and said first intensity threshold
is not selected (if conditions for first intensity thresh-
old not met, first intensity threshold not selected).

- (c) selecting a third intensity threshold (for low density
  pixels) (column 8, lines 23-34 of Kakutani) if neither of
  said first and said second intensity thresholds are select-
  ed (column 11, lines 18-26 of Kakutani - if conditions for
  neither first intensity threshold nor second intensity
  threshold are met, then neither first intensity threshold
  nor second intensity threshold are selected).

Kakutani does not disclose expressly that said first inten-
sity threshold is selected based on a selected one of a current
pixel and a neighborhood pixel; and that said second intensity
threshold is selected based on a pixel remotely neighboring said
current pixel.

Satou discloses selecting one of three intensity thresholds
(figure 14(64,65,81) and column 11, lines 21-30 of Satou) based
on a selected one of a current pixel and a neighborhood pixel
(column 11, lines 2-9 and lines 62-66 of Satou).

Kakutani and Satou are combinable because they are from the
same field of endeavor, namely the selection of one of multiple
intensity thresholds for halftoning based on the input image
data of the local neighborhood of pixels. At the time of the
invention, it would have been obvious to a person of ordinary
skill in the art to select a first intensity threshold based on
a selected one of a current pixel and a neighborhood pixel, as
taught by Satou, wherein the selection of said intensity thresh-
old is specifically based on the accumulated error, as taught by

Kakutani. A suggestion for doing so would have been that the
intensity threshold selection is based on the pixel values in
Satou, and Kakutani teaches that the accumulated error is a fun-
ction of the pixel value (figures 5-6 of Kakutani). A further
motivation for doing so would have been to increase printing/
transmission speed by sometimes relying upon neighboring pixels
for the determination of threshold, rather than the pixel itself
(column 1, lines 25-48 of Satou). Therefore, it would have been
obvious to combine Satou with Kakutani.

At the time of the filing of the Satou patent (filed 17
July 1990), the computing and printing arts were such that
expanding the neighborhood beyond the pixels immediately adja-
cent the current pixel was not practical. However, in light of
the improvements in the computing and printing arts between 17
July 1990 and 26 June 2001 (the filing date of the present
application), it would be reasonable to suggest that one of
ordinary skill in the art at the time of the invention would
conclude that one could expand the system taught by Kakutani in
view of Satou to a broader neighborhood, thus selecting said
second intensity threshold based on a pixel remotely neighboring
said current pixel. However, Kakutani in view of Satou does not
disclose expressly that said second intensity threshold is sele-
cted based on a pixel remotely neighboring said current pixel.

Ostromoukhov discloses selecting one of multiple thresholds
(figure 7(106) of Ostromoukhov) based on a larger neighborhood,
which would include at least a pixel remotely neighboring said
current pixel (figure 9; column 8, lines 41-44; column 9, lines
9-12; and column 10, line 65 to column 11, line 4 of Ostromouk-
hov).

Kakutani in view of Satou is combinable with Ostromoukhov
because they are from the same field of endeavor, namely the
selection of one of multiple intensity thresholds for halftoning
based on the input image data of the local neighborhood of
pixels. At the time of the invention, it would have been
obvious to a person of ordinary skill in the art to use a larger
neighborhood for selecting threshold values, as taught by
Ostromoukhov, said selection (taught by Satou) performed based
on accumulated error, as taught by Kakutani. Thus, the second
intensity threshold is selected based on a pixel remotely
neighboring said current pixel. The motivation for doing so
would have been to mitigate the effects of printing artifacts
that occur as a result of repetitive output (column 2, lines 6-
33 of Ostromoukhov). Therefore, it would have been obvious to
combine Ostromoukhov with Kakutani in view of Satou to obtain
the invention as specified in claim 1.

**Regarding claim 2:** Kakutani discloses that at least one of
said first and said second error thresholds is substantially
zero (column 11, lines 23-26 and column 12, lines 33-37 of
Kakutani). By setting the intensity threshold such that said
intensity threshold is optimized for high density image data,
the accumulated error is nearly, and thus substantially, zero.
For high density image data, the optimization value K is set to
8 to 24 (column 12, lines 33-37 of Kakutani). Thus, given the
equation for the intensity threshold (column 8, equation 1 of
Kakutani), the intensity threshold will be near saturation for
high density image data ($(data(i,j)*(K-1)+128)/K \approx data(i,j)*(K-1)/K$, for
large $data(i,j)$). Therefore, the acceptable accumulation error,
which is accumulated from the basic error diffusion (column 8,

equation 3 and column 9, equation 5 of Kakutani), is substantially zero.

**Regarding claim 3:** Kakutani discloses that an intensity of said first intensity threshold (for high density image data) ($slsh(i, j) = (data(i, j) * (K - 1) + 128)/K \approx data(i, j) * (K - 1)/K$, for large $data(i, j)$) is greater than an intensity of said second intensity threshold (for medium density image data) ($slsh(i, j) = (data(i, j) * (K - 1) + 128)/K$), and said intensity of said second intensity threshold is greater than an intensity of said third intensity threshold (for low density image data) ($slsh(i, j) = (data(i, j) * (K - 1) + 128)/K \approx 128/K$, for small $data(i, j)$) (column 8, equation 1 and column 11, line 61 to column 12, line 2 of Kakutani).

**Regarding claim 4:** Kakutani discloses that at least one of said accumulated error of said first pixel, said neighboring pixel, and said remote neighboring pixel comprises a component color (gray-level or luminance) error for said pixel (column 7, lines 22-26 and column 8, lines 55-60 of Kakutani).

**Regarding claim 12:** Kakutani discloses an error diffusion halftone image display method comprising the steps of:

- (a) determining an intensity of a current pixel in an image (column 8, lines 23-26 of Kakutani).

- (b) augmenting said intensity of said current pixel with a current pixel accumulated error (column 9, lines 37-40 of Kakutani).

- (c) selecting a first intensity threshold (for higher-level (192-224) medium density pixels) if at least one of said current pixel accumulated error and an immediate neighboring pixel accumulated error is less than a first error

threshold (figure 6 and column 11, line 61 to column 12, line 2 of Kakutani).

- (d) selecting a second intensity threshold (for medium-level (128-160) medium density pixels) if at least one of said current pixel accumulated error and an immediate neighboring pixel accumulated error is less than a second error threshold (figure 6 and column 11, line 61 to column 12, line 2 of Kakutani) and said first error threshold is not selected (column 8, lines 26-34 of Kakutani).

→ Further explanation of (a)-(d): The error level is different for each range of gray level values (figure 6 and column 11, line 61 to column 12, line 2 of Kakutani). Furthermore, the intensity threshold (slsh) is set with respect to the grayscale value itself (column 8, lines 26-34 of Kakutani), so the second intensity threshold cannot be selected if the first error threshold is selected. The grayscale value itself selects the intensity threshold based on the equation for slsh (column 8, lines 26-34 of Kakutani).

- (e) selecting a third intensity threshold (for lower-level (64-960) medium density pixels) if an accumulated error is less than a third error threshold (figure 6 and column 11, line 61 to column 12, line 2 of Kakutani) and neither of said first and said second errors threshold are selected (column 8, lines 26-34 of Kakutani).

- (f) selecting a fourth intensity threshold (for low density pixels) (column 8, lines 23-34 of Kakutani) if one of said first, said second, and said third intensity thresholds are not selected (column 11, lines 18-26 of Kakutani).

→ Further explanation of (e)-(f): Since the intensity thres-
hold (slsh) is set with respect to the gray-scale value
itself (column 8, lines 26-34 of Kakutani), the third
intensity threshold cannot be selected if either the first
error threshold or the second error threshold is selected.
The grayscale value itself selects the intensity threshold
based on the equation for slsh (column 8, lines 26-34 of
Kakutani).

• (g) displaying said current pixel with one of a first disp-
layed intensity (255) if said augmented intensity of said
current pixel exceeds said selected intensity threshold and
otherwise displaying said current pixel with a second disp-
layed intensity (0) (column 8, lines 44-50 of Kakutani).

• (h) assigning an accumulated error between said displayed
intensity and said augmented intensity of said current
pixel to at least one pixel neighboring said current pixel
(column 8, lines 55-61 of Kakutani).

Kakutani does not disclose expressly that said first inten-
sity threshold is selected based on a selected one of a current
pixel and a neighborhood pixel; that said second intensity
threshold is selected based on a pixel remotely neighboring said
current pixel; and that said third intensity is selected based
on a more remote neighboring pixel.

Satou discloses selecting one of three intensity thresholds
(figure 14(64,65,81) and column 11, lines 21-30 of Satou) based
on a selected one of a current pixel and a neighborhood pixel
(column 11, lines 2-9 and lines 62-66 of Satou).

Kakutani and Satou are combinable because they are from the
same field of endeavor, namely the selection of one of multiple
intensity thresholds for halftoning based on the input image

data of the local neighborhood of pixels. At the time of the
invention, it would have been obvious to a person of ordinary
skill in the art to select a first intensity threshold based on
a selected one of a current pixel and a neighborhood pixel, as
taught by Satou, wherein the selection of said intensity thresh-
old is specifically based on the accumulated error, as taught by
Kakutani. A suggestion for doing so would have been that the
intensity threshold selection is based on the pixel values in
Satou, and Kakutani teaches that the accumulated error is a fun-
ction of the pixel value (figures 5-6 of Kakutani). A further
motivation for doing so would have been to increase printing/
transmission speed by sometimes relying upon neighboring pixels
for the determination of threshold, rather than the pixel itself
(column 1, lines 25-48 of Satou). Therefore, it would have been
obvious to combine Satou with Kakutani.

At the time of the filing of the Satou patent (filed 17
July 1990), the computing and printing arts were such that expa-
nding the neighborhood beyond the pixels immediately adjacent
the current pixel was not practical. However, in light of the
improvements in the computing and printing arts between 17 July
1990 and 26 June 2001 (the filing date of the present applicati-
on), it would be reasonable to suggest that one of ordinary
skill in the art at the time of the invention would conclude
that one could expand the system taught by Kakutani in view of
Satou to a broader neighborhood, thus selecting said second
intensity threshold based on a pixel remotely neighboring said
current pixel and selecting said third intensity threshold based
on a pixel more remotely neighboring said current pixel. Howev-
er, Kakutani in view of Satou does not disclose expressly that
said second intensity threshold is selected based on a pixel

remotely neighboring said current pixel; and that said third
intensity is selected based on a more remote neighboring pixel.

Ostromoukhov discloses selecting one of multiple thresholds
(figure 7(106) of Ostromoukhov) based on a larger neighborhood,
which would include at least a pixel remotely neighboring said
current pixel and a pixel more remotely neighboring said current
pixel (figure 9; column 8, lines 41-44; column 9, lines 9-12;
and column 10, line 65 to column 11, line 4 of Ostromoukhov).

Kakutani in view of Satou is combinable with Ostromoukhov
because they are from the same field of endeavor, namely the
selection of one of multiple intensity thresholds for halftoning
based on the input image data of the local neighborhood of pixe-
ls.  At the time of the invention, it would have been obvious to
a person of ordinary skill in the art to use a larger neighbor-
hood for selecting threshold values, as taught by Ostromoukhov,
said selection (taught by Satou) performed based on accumulated
error, as taught by Kakutani.  Thus, the second intensity thres-
hold is selected based on a pixel remotely neighboring said
current pixel, and the third intensity threshold is selected
based on a pixel more remotely neighboring said current pixel.
The motivation for doing so would have been to mitigate the
effects of printing artifacts that occur as a result of repetit-
ive output (column 2, lines 6-33 of Ostromoukhov). Therefore, it
would have been obvious to combine Ostromoukhov with Kakutani in
view of Satou to obtain the invention as specified in claim 12.

**Regarding claim 13:** Kakutani discloses that at least one
of said first, said second, and said third error thresholds is
substantially zero accumulated error (column 11, lines 23-26 and
column 12, lines 33-37 of Kakutani).  By setting the intensity
threshold such that said intensity threshold is optimized for

low density image data, the accumulated error is nearly, and
thus substantially, zero.  For low density image data, the
optimization value K is set to 8 to 24 (column 12, lines 33-37
of Kakutani).  Thus, given the equation for the intensity
threshold (column 8, equation 1 of Kakutani), the intensity
threshold will be near zero for low density image data
($(data(i,j)*(K-1)+128)/K \approx 128/K$, for small $data(i,j)$).  Therefore, the
acceptable accumulation error, which is accumulated from the
basic error diffusion (column 8, equation 3 and column 9,
equation 5 of Kakutani), is substantially zero.

**Regarding claim 14:**  Kakutani discloses that said first
displayed intensity comprises a maximum intensity (255) and said
second displayed intensity comprises a minimum intensity (0) for
said pixel (column 8, lines 44-50 of Kakutani).

**Regarding claim 15:**  Kakutani discloses that said intensity
of said current pixel comprises an intensity of a color compon-
ent (gray) of said pixel (column 7, lines 22-26 of Kakutani).

**Regarding claim 16:**  Kakutani discloses that an intensity
of said first intensity threshold (for higher-level (192-224)
medium density pixels) is greater than an intensity of said
second intensity threshold (for medium-level (128-160) medium
density pixels), said intensity of said second intensity thresh-
old is greater than an intensity of said third intensity thresh-
old (for lower-level (64-960) medium density pixels), and said
intensity of said third intensity threshold is greater than an
intensity of said fourth intensity threshold (for low density
pixels) (column 8, equation 1 and column 11, line 61 to column
12, line 2 of Kakutani).  For a set K value (column 11, line 61
to column 12, line 2 of Kakutani), the equation for the thresh-
old value ($slsh(i,j)=(data(i,j)*(K-1)+128)/K$) is linearly dependent

upon the gray level value itself.  Thus, the first intensity
threshold (for higher-level (192-224) medium density pixels) is
greater than an intensity of said second intensity threshold
(for medium-level (128-160) medium density pixels), which is
greater than an intensity of said third intensity threshold (for
lower-level (64-960) medium density pixels), which is greater
than an intensity of said fourth intensity threshold (for low
density pixels).

**Regarding claim 17:**  Kakutani further discloses the step of
displaying said current pixel with a maximum displayed intensity
if said augmented intensity of said current pixel exceeds a
fifth intensity threshold (for high density pixels) (column 8,
lines 44-50 of Kakutani), an intensity of said fifth intensity
threshold being greater than an intensity of said first intensi-
ty threshold (for higher-level (192-224) medium density pixels)
(column 8, lines 23-34 of Kakutani).  For a set K value (column
11, line 61 to column 12, line 2 of Kakutani), the equation
( $slsh(i, j) = (data(i, j) * (K-1) + 128)/K$ ) for the threshold value is linearly
dependent upon the gray level value itself.  Thus, the intensity
of said fifth intensity level threshold (for high density pixe-
ls) is greater than the intensity of said first intensity level
threshold (for higher-level (192-224) medium density pixels).

**Regarding claim 18:**  Kakutani discloses that at least one
of said current pixel accumulated error, said neighboring pixel
accumulated error, and said remote neighboring pixel accumulated
error comprises a component color (gray-level or luminance)
error (column 7, lines 22-26 and column 8, lines 55-60 of
Kakutani).

6.     Claims 5-11 are rejected under 35 U.S.C. 103(a) as being
unpatentable over Kakutani (US Patent 5,553,166) in view of
Satou (US Patent 5,159,471).

**Regarding claim 5:**   Kakutani discloses a halftone image
display method having an accumulated error assigned to at least
one pixel of an image (column 10, lines 53-64 of Kakutani),
where said error is based upon a comparison between a pixel
value of an input image and a corresponding pixel value of an
output image (column 8, lines 55-60 of Kakutani), said method
comprising the steps of:

- (a) determining an intensity of a current pixel in an image
  (column 8, lines 23-26 of Kakutani).

- (b) augmenting said intensity of said current pixel with a
  current said accumulated pixel error (column 9, lines 37-40
  of Kakutani).

- (c) selecting a first intensity threshold (for medium
  density pixels) (column 11, line 61 to column 12, line 2 of
  Kakutani) if at least one of said current said accumulated
  pixel error and a neighboring said accumulated pixel error
  is less than an error threshold (column 10, lines 40-64 of
  Kakutani) and otherwise selecting a second intensity thres-
  hold (for low density pixels) (column 11, line 61 to column
  12, line 2 of Kakutani).  The accumulated pixel error for
  low density pixels is generally large (column 10, lines 53-
  64 of Kakutani), unlike the medium density pixels, as
  further demonstrated in the graph shown in figure 6 of
  Kakutani.

- (d) displaying said current pixel with one of a first
  displayed intensity (255) if said augmented intensity of
  said current pixel exceeds said selected intensity

threshold and otherwise displaying said current pixel with
a second displayed intensity (0) (column 8, lines 44-50 of
Kakutani).

- (e) assigning a said accumulated error between said
  displayed intensity and said augmented intensity of said
  current pixel to at least one pixel neighboring said
  current pixel (column 8, lines 55-61 of Kakutani).

Kakutani does not disclose expressly that said first
intensity threshold is selected based on a selected one of a
current pixel and a neighborhood pixel.

Satou discloses selecting one of three intensity thresholds
(figure 14(64,65,81) and column 11, lines 21-30 of Satou) based
on a selected one of a current pixel and a neighborhood pixel
(column 11, lines 2-9 and lines 62-66 of Satou).

Kakutani and Satou are combinable because they are from the
same field of endeavor, namely the selection of one of multiple
intensity thresholds for halftoning based on the input image
data of the local neighborhood of pixels.  At the time of the
invention, it would have been obvious to a person of ordinary
skill in the art to select a first intensity threshold based on
a selected one of a current pixel and a neighborhood pixel, as
taught by Satou, wherein the selection of said intensity thresh-
old is specifically based on the accumulated error, as taught by
Kakutani.  A suggestion for doing so would have been that the
intensity threshold selection is based on the pixel values in
Satou, and Kakutani teaches that the accumulated error is a
function of the pixel value (figures 5-6 of Kakutani).  A
further motivation for doing so would have been to increase
printing/transmission speed by sometimes relying upon neighbor-
ing pixels for the determination of threshold, rather than the

pixel itself (column 1, lines 25-48 of Satou).   Therefore, it
would have been obvious to combine Satou with Kakutani to obtain
the invention as specified in claim 5.

**Regarding claim 6:**  Kakutani discloses that said error
threshold is substantially zero (column 11, lines 23-26 and
column 12, lines 33-37 of Kakutani).   By setting the intensity
threshold such that said intensity threshold is optimized for
high density image data, the accumulated error is nearly, and
thus substantially, zero.   For high density image data, the
optimization value K is set to 8 to 24 (column 12, lines 33-37
of Kakutani).   Thus, given the equation for the intensity
threshold (column 8, equation 1 of Kakutani), the intensity
threshold will be near saturation for high density image data
($(data(i,j)*(K-1)+128)/K \approx data(i,j)*(K-1)/K$, for large $data(i,j)$).   There-
fore, the acceptable accumulation error, which is accumulated
from the basic error diffusion (column 8, equation 3 and column
9, equation 5 of Kakutani), is substantially zero.

**Regarding claim 7:**  Kakutani discloses that said first
displayed intensity comprises a maximum intensity (255) and said
second displayed intensity comprises a minimum intensity (0)
(column 8, lines 44-50 of Kakutani).

**Regarding claim 8:**  Kakutani discloses that said intensity
of said current pixel comprises an intensity of a color compon-
ent (gray) of said pixel (column 7, lines 22-26 of Kakutani).

**Regarding claim 9:**  Kakutani discloses that an intensity of
said first intensity threshold (for medium density image data)
($slsh(i,j) = (data(i,j)*(K-1)+128)/K$) is greater than an intensity of
said second intensity threshold (for low density image data)
($slsh(i,j) = (data(i,j)*(K-1)+128)/K \approx 128/K$, for small $data(i,j)$) (column 8,
equation 1 and column 12, lines 34-37 of Kakutani).

   **Regarding claim 10:**  Kakutani discloses the step of displaying said current pixel with said first displayed intensity (column 8, lines 44-50 of Kakutani) if said augmented intensity of said current pixel (column 9, equation 5 of Kakutani) exceeds a third intensity threshold (for high density image data) (column 8, lines 44-50 and column 12, lines 33-37 of Kakutani), an intensity of said third intensity threshold being greater than an intensity of said first threshold intensity threshold (column 8, equation 1 and column 12, lines 33-37 of Kakutani). Using the equation for the threshold (column 8, equation 1 of Kakutani) and the value of K for high density image data (column 12, lines 33-37 of Kakutani), it is clear that an intensity of the third intensity threshold (for high density image data)

$slsh(i,j) = (data(i,j)*(K-1)+128)/K \approx data(i,j)*(K-1)/K$ , for large $data(i,j)$ )

is greater than an intensity of the first intensity threshold (for medium density image data $slsh(i,j) = (data(i,j)*(K-1)+128)/K$ ).

   **Regarding claim 11:**  Kakutani discloses that at least one of said current said accumulated pixel error and said neighboring accumulated pixel error comprises a component color (gray-level or luminance) error (column 7, lines 22-26 and column 8, lines 55-60 of Kakutani).


7.   Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kakutani (US Patent 5,553,166) in view of Satou (US Patent 5,159,471), Ostromoukhov (US Patent 6,356,362 B1) and Harrington (US Patent 6,072,591).

   **Regarding claim 19:**  Kakutani in view of Satou and Ostromoukhov does not disclose expressly that said component color error comprises an error for a component color other than the component color of the current pixel.

Harrington discloses an error for a component color other than the component color of the current pixel (column 5, lines 27-30 and lines 50-57 of Harrington). By computing sums (column 5, lines 27-30 of Harrington) and differences (column 5, lines 50-57 of Harrington) of the primary color components (CMY), the error is determined for color components that not the component color of said current pixel (column 5, lines 27-30 and lines 50-57 of Harrington).

Kakutani in view of Satou and Ostromoukhov is combinable with Harrington because they are from the same field of endeavor, namely digital image halftoning and error diffusion. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to perform error diffusion for multiple colors using the sum and difference components taught by Harrington for error diffusion. The motivation for doing so would have been to provide for color image processing, which is generally a desirable goal in the digital image processing arts, and using said sum and difference components simplifies error diffusion calculations when there are multiple color components (column 2, lines 61-64 of Harrington). Therefore, it would have been obvious to combine Harrington with Kakutani in view of Satou and Ostromoukhov to obtain the invention as specified in claim 19.

8.    Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kakutani (US Patent 5,553,166) in view of Zlotnick (US Patent 6,351,566 B1).

Regarding claim 21: Kakutani does not disclose expressly an initial thresholding unit comparing said input intensity of said current pixel to an initial threshold intensity, said

initial threshold being greater than said selected threshold
intensity.

Zlotnick discloses an initial thresholding unit (figure 4
(44) of Zlotnick) for comparing said input intensity of said
current pixel to an initial threshold intensity (T+D/2) (figure
5(54) and column 8, lines 5-11 of Zlotnick). Since D is clearly
a positive number (column 8, lines 5-11 of Zlotnick), said
initial threshold intensity (T+D/2) is greater than one of the
possible selected intensity thresholds (T). Since the other
possibly selected intensity threshold (figure 6("AVERAGE") of
Zlotnick) is for use with intermediate values (column 8, lines
8-14 of Zlotnick), said other intensity threshold is less than
(T). Therefore, said initial intensity threshold is greater
than said selected threshold intensity.

Kakutani is analogous art since Kakutani is in the same
field of endeavor as the present application, namely digital
image halftoning and error diffusion. Kakutani and Zlotnick are
combinable because they are from similar problem solving areas,
namely selectively halftoning digital image data for pixel value
regions including (1) white or near-white, (2) black or near-
black, and (3) the gray levels in between. At the time of the
invention, it would have been obvious to a person of ordinary
skill in the art to include the initial thresholding unit taught
by Zlotnick before the threshold selection unit. The motivation
for doing so would have been to be able to determine initially
which category the input image pixel falls into (column 8, lines
8-14 of Zlotnick), which is useful in the system of Kakutani
since Kakutani also operates with respect to which category the
input image pixel falls into (figure 6 and column 11, line 61 to
column 12, line 2 of Kakutani). Thus, including the initial

thresholding unit of Zlotnick into the system taught by Kakutani
would improve the overall image data processing and increase
processing efficiency and accuracy by clearly setting forth in
advance how the input pixels are to be processed.  Therefore, it
would have been obvious to combine Zlotnick with Kakutani to
obtain the invention as specified in claim 21.
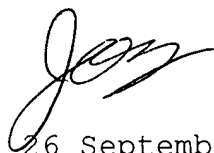
## *Conclusion*

9.   Applicant's amendment necessitated the new ground(s) of
rejection presented in this Office action.  Accordingly, **THIS
ACTION IS MADE FINAL.**  See MPEP § 706.07(a).  Applicant is
reminded of the extension of time policy as set forth in 37
CFR 1.136(a).

A shortened statutory period for reply to this final action
is set to expire THREE MONTHS from the mailing date of this
action.  In the event a first reply is filed within TWO MONTHS
of the mailing date of this final action and the advisory action
is not mailed until after the end of the THREE-MONTH shortened
statutory period, then the shortened statutory period will
expire on the date the advisory action is mailed, and any
extension fee pursuant to 37 CFR 1.136(a) will be calculated
from the mailing date of the advisory action.  In no event,
however, will the statutory period for reply expire later than
SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier
communications from the examiner should be directed to James A.
Thompson whose telephone number is 571-272-7441.  The examiner
can normally be reached on 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David K. Moore can be reached on 571-272-7437. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

James A. Thompson
Examiner
Technology Division 2625

26 September 2006

DAVID MOORE
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2600